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(54) Paper detection device for printers

(57) A sheet S, figure 2(b), approaching the detection device in its rest position, figure 2(a), pivots auxiliary lever 22 anticlockwise about shaft 25 until lever arm 23 abuts part 20 of main lever 12, the levers 22 and 12 then pivoting together anticlockwise to the figure 2(b) position to permit passage of the sheet. Lever 12 includes an apertured shield 15 to trip a photoelectric sensor 28. The levers are returned to the rest position by weights 23 and 14. Reverse feed of a sheet pivots lever 22, but not lever 12, clockwise from the rest position.

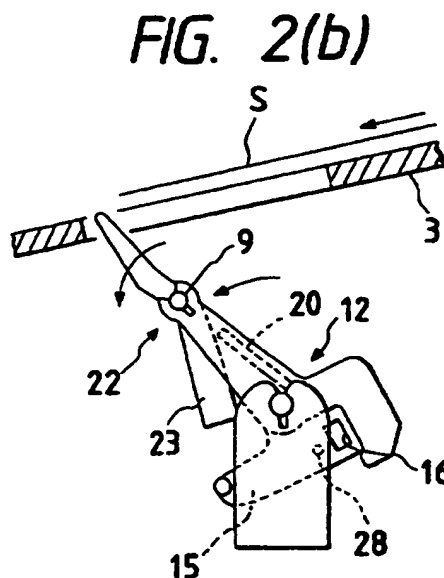
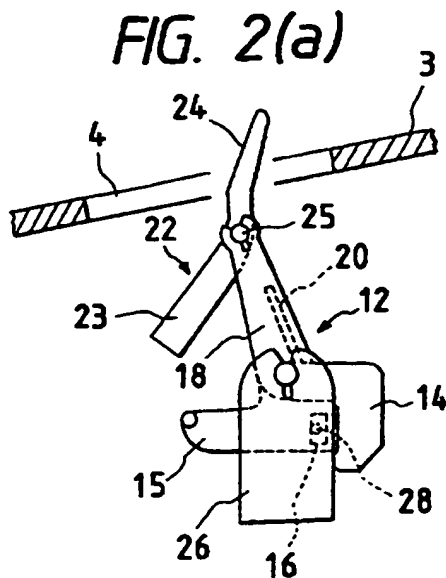


FIG. 1

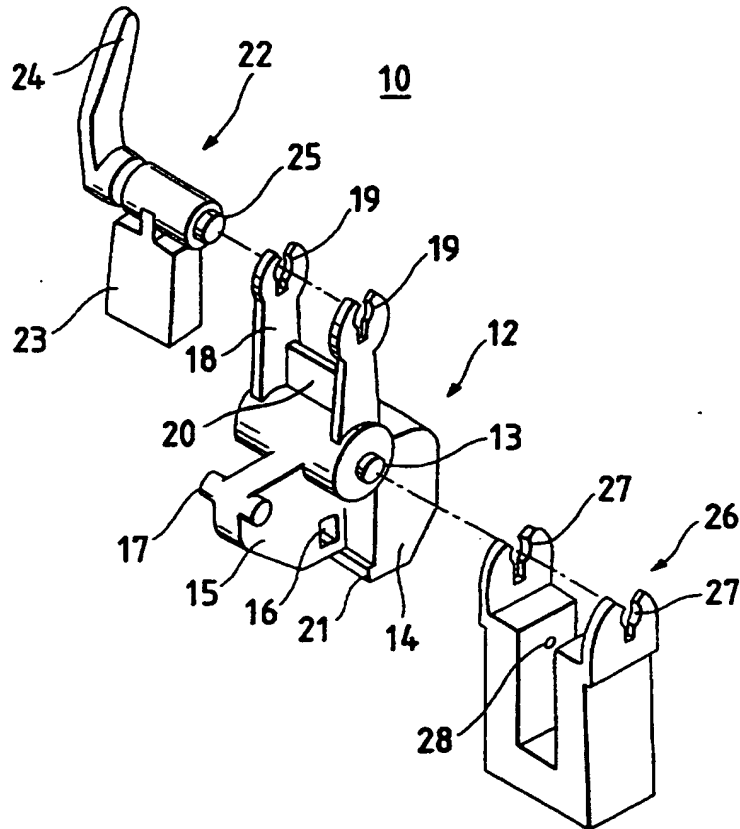


FIG. 3

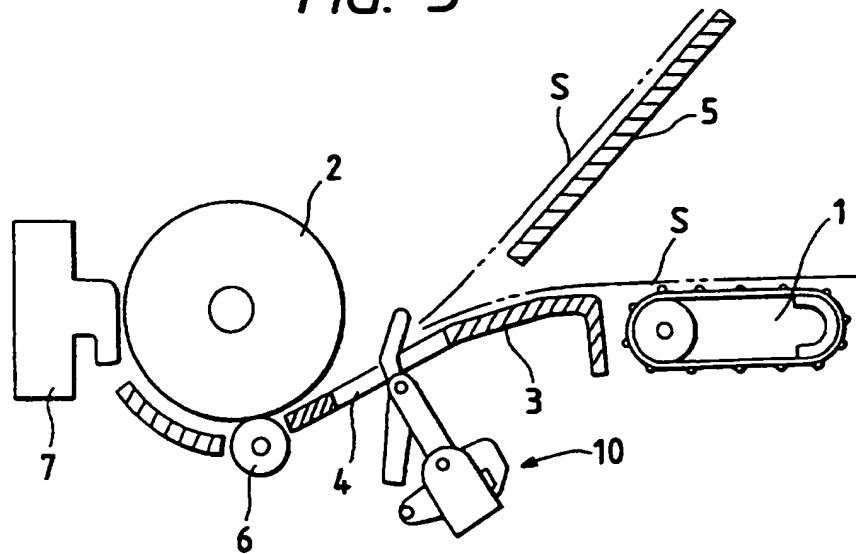


FIG. 2(a)

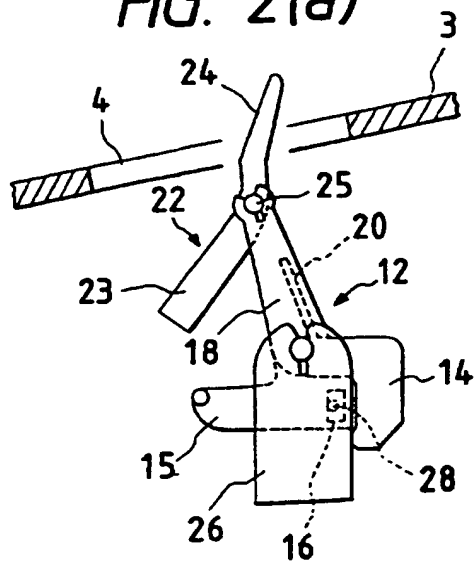


FIG. 2(b)

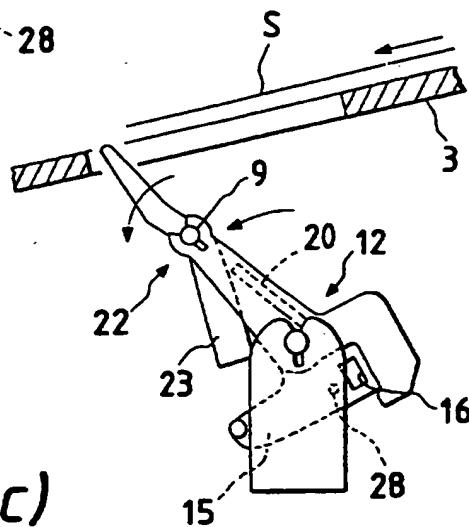
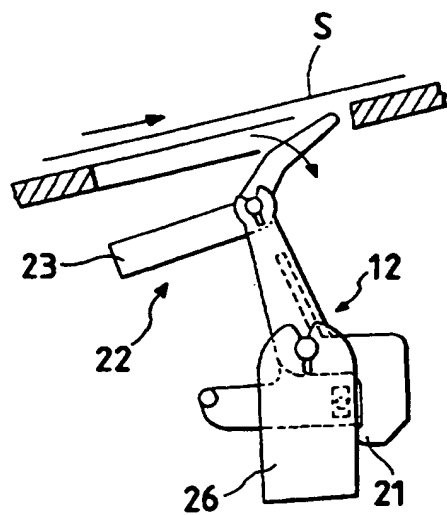


FIG. 2(c)



PAPER DETECTION DEVICE FOR PRINTER

The present invention relates to a paper detection device for a printer.

For instance, a printer, having the facility to print on both cut sheets and continuous form, needs to draw back a loaded continuous form from a printing area before printing on a cut sheet or to draw out a cut sheet when treating a paper jam.

A detection sensor published on Japanese Utility Model Publication No. Hei. 3-43015 has a sheet end detection lever formed as an angled bar which can go back from a sheet feed passage when a print sheet is fed in either direction.

The angled detection lever, however, has some inconveniences in that inaccurate paper detection results from the fact that a detection timing is dependent on paper stiffness and lever rigidity. Thus, for instance, when part of the angled lever passes the print sheet, the detection lever should react and sometimes doesn't.

The present invention concerns such a problem as described above. Thus the object of the present invention is to provide a new paper detection device which performs accurate paper detection without any trouble in either sheet feed direction.

According to an aspect to the present invention, there is provided a paper detection device for a printer including: a support member; a main lever pivotably mounted on the support member, wherein the main lever has a self-resetability to an upright position and is pivotable only in a sheet-forward-feed-direction; an auxiliary lever pivotably mounted on the main lever, including a free end protruding into a sheet passage, wherein the auxiliary lever has a self-resetability to an upright position, is pivotable with respect to the main lever only in a sheet-reverse-feed direction, and moves the main lever in the

sheet-forward-feed direction when the free end thereof is urged to the sheet-forward-feed direction.

Embodiments of the present invention will now be described with reference to the accompanying drawings, of which:

Fig. 1 is an exploded perspective view of a paper detection device according to the present invention;

Figs. 2(a) through 2(c) are respectively showing the actions at the non-paper detection state, the forward sheet feed state and the reverse feed state; and

Fig. 3 is a drawing showing a printer equipped with the paper detection device described above.

An embodiment of the present invention is described below.

As in Fig. 3, a paper detection unit 10 is located in a position where a sheet guide 3, which extends from a push tractor 1 to a platen 2, joins a sheet guide 5, which extends from a cut sheet feeder which is not shown in the figure to the platen 2.

The figure also shows a pinch roller 6, which is located in a position which is capable of contacting and separating from the circumferential surface of the platen 2, and a print head 7.

As shown in Fig. 1, the paper detection unit 10 includes: a main lever 12, which detects paper presence at the forward feeding of a print sheet S by rotating in the sheet-feed direction (counter-clockwise rotation in Fig. 3) while being pushed by its front edge in contact with; an auxiliary lever 22, which is pivotably supported at the end of the

main lever 12 so as to allow the sheet to pass through its rotation in the counter-sheet-feed direction at the reverse sheet feeding; and a support member 26 which pivotably supports the main lever 12.

The main lever 12 includes a weight 14 and a light shield plate 15, which are formed on the lower half of a shaft 13, if halved in its longitudinal centre, and also includes a U-shape arms 18 for supporting the auxiliary lever 22, which are formed on the upper half. The main lever 12 is supported pivotably on the support member 26 in such a manner that the upright position is maintained by the weight 14 so that a window hole 16 drilled through the light shield plate 15 should normally align with the optical path of the paper detection sensor 28 on the support member. The main lever 12 is constructed in such a manner that the optical path will be interrupted by the light shield plate 15 if the main lever 12 rotates in the sheet-feed direction while being pushed by the front edge of the print sheet S. The optical path through hole 16 allows detection of the print sheet S being fed in.

Stoppers 17 and 21 in the figure are provided respectively on a part of the light shield plate 15 and the weight 14 so as to control excessive rotations.

The auxiliary lever 22, pivotably supported by shaft bearings 19 located at the free ends of the U-shape arms 18 of the main lever 12 via shaft 25, in such a manner that a free end 24 normally protrudes through a slit in the sheet guide 3 by means of a weight 23 located on the lower half. The auxiliary lever 22 is constructed in such a manner that rotation in the sheet-feed direction will be controlled by a rotation control piece 20 provided with the U-shape arms 18 so as to rotate in the sheet-feed direction together with the main lever 12 at the time of normal sheet feed.

On the other hand, the support member 26, which is formed in a U-shape and is secured on the frame of a printer main body, not shown in the figures, pivotably

supports the main lever 12 with shaft bearings 27 located on its upper part. A photoelectric-converter-type paper detection sensor 28, which includes a light emitting element and a light receiving element for detection of paper presence by means of displacement of the light shield plate 15, is provided on the mutually facing inner walls of its main body.

In such a device as constructed as above, the main lever 12 is in the upright position by the weight 14 as in Fig. 2(a) while in the state where the sheet S is not detected. The window hole 6 is positioned in line with the optical path of the paper detection sensor 28 located inside the support member 26. The free end 24 protrudes through the slit 4 in the sheet guide plate 3. The auxiliary lever 22, pivotably supported at the free ends of the U-shape arms 18, is maintained in the upright position by the weight 23.

When the print sheet S, such as a continuous form or a cut sheet, is fed from the push tractor 1 or from a cut sheet feeder, not shown in the figures, as shown in Fig. 2(b), under this condition, the auxiliary lever 22 is pushed by the front edge of the print sheet S and rotates in the sheet-feed direction (the direction of the arrow in the figure). Then the auxiliary lever 22 further rotates counter-clockwise together with the main lever 12 when the weight 23 comes into contact with the rotation control piece 20. This allows the print sheet S to pass by shunting the unit 10 below the sheet guide plate 3. In feeding of the print sheet S is simultaneously detected with this counter-clockwise rotation of the main lever 12 which displaces the window hole 16 in the light shield plate 15 from the optical path of the paper detection sensor 28 to block incidence into the light receiving element.

When the rear edge of the print sheet S passes away in such a manner as above, the auxiliary lever 22 immediately rotates clockwise as shown in the figures with its own weight 23 and resets the main lever 12 to the original position as shown in Fig. 2(a).

Also by immediately rotating the main lever 12 clockwise in the figure with the weight 14 on undoing the contact with the rotation control piece 20.

When a cut sheet already fed in is drawn back due to for example a paper jam, as shown in Fig. 2(c), the paper detection unit 10 allows reverse sheet feed by rotating clockwise in the figures. The main lever 12 is maintained in the upright position by putting the stopper 21 in contact with the lateral wall of the support member 26. After the sheet passes away, the auxiliary lever 22 immediately rotates counter-clockwise with its own weight 23 and resets to the position shown in Fig. 2(a).

According to the present invention, as described above, since the auxiliary lever, which is provided with the function of self-resetting to the upright position, is supported by the main lever, which is provided with the function of self-resetting to the upright position and which rotates only in the sheet-feed direction, so as to protrude normally into the sheet transport way and rotates only in counter-sheet-feed direction, paper detection is performed by immediately rotating the main lever in the sheet-fed direction via the auxiliary lever. There is no time lag at the time of normal sheet feed and the levers immediately reset to their original position by their self-reset function after the print sheet passes away. In addition, only the auxiliary lever is rotated to feed the print sheet without any trouble at the time of reverse sheet feed.

The foregoing description has been given by way of example only and it will be appreciated by a person skilled in the art that modifications can be made without departing from the scope of the present invention.

CLAIMS:

1. A paper detection device for a printer, comprising:

a support member;

a main lever pivotably mounted on the support member, wherein the main lever is able to reset itself to an upright position and is pivotable only in a sheet-forward-feed-direction; and

an auxiliary lever pivotably mounted on the main lever, including a free end protruding into a sheet passage of the printer, wherein the auxiliary lever is able to reset itself to an upright position, is pivotable with respect to the main lever only in a sheet-reverse-feed direction, and moves the main lever in the sheet-forward-feed direction when the free end thereof is urged to the sheet-forward-feed direction.

2. The sheet detection device according to claim 1, wherein the support member includes a photoelectric-converting detector, and the main lever includes an interrupting portion for interrupting an optical path of the photoelectric-converting detector.

3. The sheet detection device according to claim 1 or 2, wherein the main lever includes a control plate piece in contact with the auxiliary lever when the auxiliary lever is urged in the sheet-forward-feed direction.

4. The sheet detection device according to any one of claims 1 to 3, wherein the main lever includes a weight for urging the main lever to the upright position.

5. The sheet detection device according to any one of claims 1 to 4, wherein the auxiliary lever includes a weight for urging the auxiliary lever to the upright position.

6. The sheet detection device according to claim 5, when dependent on claim 3, wherein the control plate piece is in contact with the weight of the auxiliary lever when the auxiliary lever is urged in the sheet-forward-feed direction.

7. The sheet detection device substantially as hereinbefore described with reference to any one of the figures.

CLAIMS:

1. A paper detection device for a printer, comprising:
 - a support member;
 - a main lever pivotably mounted on the support member;
 - an auxiliary lever pivotably mounted on the main lever and comprising a free end for protruding into a sheet passage of the printer to contact paper therein; and
 - paper detection means;wherein:
 - the auxiliary lever is pivotable between a rest position when its free end is not in contact with paper and at least one paper contact position, and is gravity biased towards its rest position;
 - the main lever is pivotable between a rest position and at least one paper contact position in response to pivoting of the auxiliary lever, and is gravity biased towards its rest position; and
 - the paper detection means is responsive to the position of the main lever.
2. A device according to claim 1, wherein the levers are pivotable between the rest position and two paper contact positions, one a sheet forward feed position and one a sheet reverse feed position.
3. A device according to claim 1 or 2, wherein the paper detection means comprises a photoelectric-converting detector included in the support member, and an interrupting portion for interrupting an optical path of the photoelectric-converting detector included in the main lever.

4. A device according to any preceding claim wherein the main lever includes a control plate piece in contact with the auxiliary lever when the auxiliary lever is urged in the sheet-forward-feed direction.
5. A device according to any preceding claim, wherein lever includes a weight for urging the main lever to the rest position.
6. A device according to any preceding claim, wherein the auxiliary lever includes a weight for urging the auxiliary lever to the rest position.
7. A device according to claim 6, when dependent on claim 4. wherein the control plate piece is in contact with the weight of the auxiliary lever when the auxiliary lever is urged in the sheet-forward-feed direction.
8. The sheet detection device substantially as hereinbefore described with reference to any one of the figures.